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ABSTRACT

This paper is a report on the implementation of a project to diffuse technology throughout a teacher education program in elementary education at Millersville University (Pennsylvania). Rather than relying on a single technology course in a preservice program, students develop technology skills in a variety of courses in the education sequence and through collaborative projects. Several ongoing projects are described that include the development of discipline specific technology courses, collaborative projects involving students and faculty, and technology projects in elementary education content courses. Challenges of technology diffusion are discussed related to guaranteeing basic computer skills for preservice teachers, supporting faculty technology integration, and the comprehensive nature of the program. (MES)

Living with Technology Diffusion Confusion

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Abstract: This paper is a report on the implementation of a project to diffuse technology throughout a teacher education program in elementary education. Rather than relying upon a single technology course in a pre-service program, students develop technology skills in a variety of courses in the education sequence and through collaborative projects. Several ongoing projects are described that include the development of discipline specific technology courses, collaborative projects involving students and faculty and technology projects in elementary education content courses.

Background

Pre-service teachers often view technology as an important, but isolated skill. In addition, they are unsure about how or when to integrate technology into the curriculum. Often the model used in pre-service programs reinforces this problem. Their primary experience with technology occurs in a stand-alone course that focuses on computer skills and they do not systematically experience technology as a tool in content area courses or during field experiences.

The teacher education program at Millersville University is committed to the goal of providing pre-service teachers with a broad range of meaningful experiences using technology for teaching and learning. A Link-to-Learn grant from the state of Pennsylvania has provided the resources for the development and implementation of a new model designed to meaningfully diffuse use of technology throughout the program. This model is currently being implemented in the elementary education program.

A Model for Diffusing Technology across the Curriculum

The model includes three parts: (1) faculty from a variety of departments integrating technology projects as a component of their courses, (2) the development of a technology course designed specifically for elementary education teachers, and (3) a series of collaborative projects and relationships involving students and faculty from both content courses and the technology course.

The overall effect of this plan is to diffuse technology education throughout the elementary education program rather than relegate it to a specific technology course. Pre-service teachers experience technology as a tool with specific content area applications. This model also allows the emphasis of the technology course to shift from just developing basic computer skills to emphasizing pedagogical issues that focus upon the implementation of technology into the curriculum.

Scope of Curriculum Integration

The first part of the model involves integrating technology across the curriculum. Nineteen faculty participated in the project and each received a stipend to develop a technology project that supports their

curriculum. The faculty represents a wide range of disciplines and all teach required courses in the elementary program. The departments involved in the project include math, special education, biology, art, music, library science, elementary education and secondary education. It is estimated that by the completion of their degree, the average elementary education student will take from 6 to 9 courses from faculty directly participating in this project. While the majority of faculty used the summer to develop projects for implementation for the fall 1999 semester, the rest will begin implementation during winter the spring sessions. Faculty participating in the project received one-to-one assistance to develop and implement technology projects that support curriculum in courses for elementary education majors. The project covers a full two semesters, which allows for the opportunity of continual technology support and collaboration in regards to pedagogical issues.

Discipline Specific Technology Course for Elementary Education

The second part of the model involves development of discipline specific technology courses. The required technology course for education majors has undergone a radical change. In its place is a set of technology courses designed for specific disciplines. Special education, music education, art education and elementary education have technology courses designed to meet the needs of the teachers in those areas. In addition, secondary social studies, English, math, science and foreign language students are placed in individual technology courses that correspond to the methods course in a junior block. There are several purposes for this change: 1) Since the inception of the required technology course for education majors some 14 years ago, technology has undergone a tremendous change resulting in a proliferation of discipline specific products. The student makeup of the previous generic technology course included a mix of both elementary and secondary students from different disciplines making it extremely difficult or impossible to adequately cover discipline specific software; 2) The focus of the technology courses is shifting from technological skills to pedagogical skills for integrating technology. Issues facing elementary education majors are different from those facing secondary education majors. Elementary education majors must consider developmentally appropriate uses of technology and need to learn to integrate technology across the curriculum. Elementary education majors also need strategies for supporting young students in the use of technology; and 3) An instructional technology course consisting exclusively of discipline specific education majors provides opportunities for collaborations with other populations of pre-service teachers.

Collaborative Projects involving Pre-service Teachers and Faculty

The third part of the model focuses upon collaborative projects involving students and faculty from more than one course. During the fall semester of 1999, two collaborative projects involving students and faculty from several sections of the third year elementary education technology course and a first year introductory elementary education course were implemented. One project involved third year students mentoring first year students, and in the other, first year students were required to evaluate technology projects produced by third year students.

The mentoring project involved about 50 third year students in the technology course and approximately 100 first year students from Introduction to Elementary Education, the first education course in the elementary education sequence. First, students in the third year technology course learned internet and web editing skills by developing a K-6 topics web page with text, graphics and links and uploading it to a server. With these newly learned skills, the peer mentors then taught freshmen students the basic technology skills required for completing an assignment which involved developing a web page and uploading it to a server. The mentoring took place over a 5-week time frame and the third year students were responsible for scheduling instruction and developing strategies for helping their peers.

The outcomes expressed by the third year students were very positive. In reviewing student reflections about the project, many cited a feeling of accomplishment, developing confidence in their abilities to teach, and that they were doing something useful. Comments about being flexible and realizing the importance of having a plan were recurring themes. Some unexpected or peripheral outcomes included discussions between first and third year students about the education major and college experiences in general.

First year students also responded positively to the experience and viewed it as a great confidence builder. A recurring theme was they were surprised about how easy it was and the simplicity of the process. Many had wondered how web pages were created and the assignment answered those questions. A few students went beyond the assignment by eliciting information from their mentors about the education program and describing the experience as an opportunity to talk with upper classmen in the education program.

Some of the frustrations experienced were technical problems in uploading the files to the server. Most often cited were error factors involving user names, passwords, and incorrect input of file locations during uploading. Other frustrations involved the inability of some students in keeping scheduled meetings or in contacting peers. Students suggested that part of this could be resolved by distributing phone numbers and e-mail addresses to both mentors and peers. During the first implementation of the project, the mentors were responsible for contacting their peers. Since some students waited till the last minute to contact their peers, several first year students were very anxious about completing their project in a timely fashion and requested phone numbers from their instructors.

In the second project, first year student evaluated technology projects created by third year students. In the introductory elementary education course, a module involves discussions about setting up an elementary classroom and how the classroom needs to accommodate a variety of uses and student differences. From this discussion, the first year students developed a rubric for evaluating the functionality of an elementary classroom. This rubric then served as the basis for a technology project for third year students. The technology project consisted of third year students using the rubric to design and create an ideal classroom by using a draw program, one of the competencies of the computer course. The completed design was then uploaded to a server so that first year students could access and evaluate the projects. After the ideal classroom projects were evaluated, first year students were required to write a rationale explaining the reasons for their choices. The written reports were presented as feedback for the third year students (each project was reviewed by three first year students) and comprised 50 percent of their grade.

The outcomes of the project were very beneficial. For the first year students, it gave them a set of unique examples to which they could apply theory to practice. The abundant set of examples also served as a focus for much discussion during class time. For third year students, in addition to learning new computer skills, the project represented the practical application of computer software to solve a problem, or designing a classroom environment for a future classroom. Since the completed project was uploaded to a server, the web site enabled all of the students from all sections to see each other's work, something that was not possible before.

Challenges of Technology diffusion

Diffusion of technology education throughout the curriculum is a complex and challenging process. While the potential benefits are enormous, there are also significant challenges. The model implies that the curriculum that was once taught in a single course by a few specialized faculty members is now integrated across a large number of courses from departments across the university. This process of technology education decentralization raises two key challenges. First, how can a decentralized approach guarantee that students will meet a broad range of technology competencies without undo overlap? Second, will students gain these competencies in an appropriate sequence?

An example serves to demonstrate how these issues can have very real implications. A professor teaching a course in children's literature would like to involve students in making HyperStudio presentations of poetry for children. This project is wonderful because it provides a model for using multimedia to construct meaningful literary projects and it helps pre-service teachers see that they can use the same approach with their future students. In planning for this project, can the professor assume that students will know how to use HyperStudio or that they can learn it on their own? Should HyperStudio also be taught in a technology course or should the focus shift to the pedagogy of constructivist use of multimedia?

Guaranteeing Basic Computer Skills for Pre-service Teachers

Clearly, there must be support mechanisms in place for students to acquire the necessary skills if more and more technology is integrated into content courses. As technology takes on a greater role outside of the required technology course, students need information on a timely basis and cannot wait till the technology course. Limiting skill acquisition to the technology course severely restricts its possible uses and applications in other courses. If it makes pedagogical sense to use HyperStudio or to create a web page in a course outside of the technology course, then the technology should be used to support the instruction. The question becomes, how do students get the necessary instruction?

One possibility is through a mentoring program of skilled students teaching first year students the appropriate basic skills for a specific project. Even though in-coming freshman display greater computer savvy than the year before, many are still limited in their basic computer knowledge or are not familiar with specific educational software. A mentoring program requires a great deal of collaboration among university faculty, but

from the results of the mentoring program described earlier, can have very beneficial results. For example, first year students learned the basic skills required for creating and uploading a web page and the technology students got to practice teaching a skill set to peers. They also learned that relying on peers for new learning is something that will carry over into their new professional life as in-service teachers and many third year students commented that the mentoring experience helped bring this idea to light.

An additional support mechanism is the utilization of on-line materials for specific projects. For the projects described in this paper, a web site was created to provide context and basic start-up skills required for technology projects. The web site (http://harmony.millerv.edu) is a virtual elementary school that contains K-6 pupils, teachers, administrators, classrooms as well as case studies, rubrics, products and support materials. The help sheets are custom designed to meet the requirements of available computer lab resources and faculty assigned projects.

Supporting Faculty Technology Integration

In this project, a grant provided financial incentives for faculty to develop technology projects to support their teaching and learning. The purpose of the individual technology projects was to encourage faculty to use technology in their teaching, thus diffusing its use throughout the elementary education program. In addition, the projects were to serve as models for its use in the classroom. In order for this to happen, significant support through one-to-one tutoring sessions is available over a one-year period. In addition to the projects described earlier in this paper, below is a brief description of a number of projects currently underway.

Methods of Teaching Science

The grant provided for the acquisition of software to support technology projects in courses taken by elementary education majors. As a result, pre-service teachers in the science methods course investigate a variety of computer software products that support the teaching of science in the elementary classroom. These titles included stand-alone products as well as software designed for collaborative learning. In the course, pre-service teachers collaborate to evaluate software and to develop lesson plans for use in the classroom.

Language Arts & Children's Literature

Pre-service teachers create multi-media presentations on children's literature. Students use HyperStudio to create a presentation that tells a story and includes student narration or digitized speech. To accomplish the task, students use HelpSheets on the virtual school web site and the HyperStudio tutorial.

Fundamental Methods of Math I and II

Pre-service teachers integrate technology with hands-on collection and analysis of authentic data and functions using graphing calculators and electronic data collection instruments. Students use dynamic geometry tools to investigate geometric concepts.

The Language of Music

Pre-service teachers access a set of 60 recorded folk songs with lyrics. The musical scores are available for playback in a web based elementary classroom. Each folk song is accompanied by an activity that is appropriate for a specific age group.

The Millersville Curriculum Library

The media center in a web-based school includes tutorials for accessing traditional sources of information such as online catalogs and periodical indexes offered through the university's library. Special attention is given to evaluation and critical thinking as crucial components of Internet searching. The media center is designed to provide resources including bibliographies, tutorials, and web assignments for a variety of the content courses in the elementary education program.

Fundamentals of Studio Art

Pre-service teachers access, interpret, and evaluate a set of electronic graphic presentations created for a web-based classroom. Students use technology resources such as draw and paint programs to generate original artwork that is posted within the virtual elementary school.

Orientation to Special Education

Pre-service teachers participate in case studies presented in the web-based school involving the impact of technology on special education. These case studies include evaluation of technology applications appropriate for general and special education, technology's affect on inclusionary practices, and the use of adaptive and assistive technology. Students also use technology such as databases to analyze and summarize student performance relative to Individual Education Plans (IEP) and PowerPoint presentations for interactive student centered lessons.

Foundations of Modern Education

Pre-service teachers create documents such as brochures and newsletters using desktop publishing and other tools to creatively communicate with parents. They will also create a final project entitled, "Creating a School of the Future" that incorporates web pages and multimedia presentations.

Science Introduction to Biology

Pre-service teachers engage in several newly designed lab assignments using technology. These lab assignments will be in the form of interacting with a simulation of a biological process or responding to a case scenario on the web. Technology is used in large lecture classes associated with lab sections (1) to demonstrate concepts either visually or with simulations using multimedia presentations, (2) to support meaningful note taking in lectures and (3) to support active mini-experiments by demonstrating scientific principles and engaging students more directly in the content of the lecture.

Comprehensive Nature of Program

As noted earlier, one of the concerns that accompanies diffusion of technology education is how students will be able to gain a comprehensive set of competencies without undo repetition. The experience of this project does provides some initial answers to this question. First, the large scope of courses and departments involved in the project virtually guaranteed broad coverage of technology skills. When helping faculty plan their projects, the directors did not dictate approaches or specific technologies. Nevertheless, faculty teaching different courses and in different departments naturally choose a variety of tools for their students to use. For example, the children's literature professor wanted his students to work with HyperStudio, while the methods of teaching science professor involved her students in the use of databases and science specific software. It makes sense that incorporating technology within specific disciplines would lead to a variety of technology uses. If a particular technology tool was not included in any of the courses supporting technology integration, it might be an indication that the tool was really not a useful application for elementary education teachers. The key for this project has been encouraging faculty to integrate technology tools that make sense for the content they teach.

It has also been helpful to have regular communication and collaboration between faculty members involved in various projects. This is one of the benefits of the collaborative aspect of the model. There have been instances where professors had considered including e-mail discussion groups as part of their course, but decided not to because they knew students would be involved in such groups in several other courses. It is also helpful to have the discipline specific course in technology. Not only does this course provide for in-depth development of skills, but it also provides an environment for more in-depth reflection on the value added to specific instructional strategies by technology tools.

Conclusions

Since the implementation of the model is still underway, only preliminary conclusions can be made at this time. The mentoring project was successful in that technology support can be diffused through several mechanisms. It is clear that students can successfully teach other students while learning something in the process. As a result of instruction from third year students, the first year students were successful in completing a technology project that required the creation of a web page and uploading it to a server. Also as a result of the project, first year students developed supplemental skills involving file management such as file name conventions, creating folders, and file pathways. Additional assistance through on-line HelpSheets also supported the first year students when the mentors were not available. The combination of mentor and support materials indicates that specific computer skills can be addressed using this model.

One thing learned in working with this model is that initially the diffusion of technology throughout a program rests on the ability and willingness of faculty to collaborate. Collaboration is essential, but remains the biggest challenge. When it comes to teaching, many university faculty regard their autonomy very highly. This feeling of independence often runs in opposition to a project requiring a great deal of collaboration. Working together with other faculty to integrate technology into a course requires not only the acquisition of new skills and course modifications, but also the prospect of taking some chances. Even though there are substantial benefits from collaborative projects, this risk taking could work against faculty members in terms of student course evaluations, a necessary part of the promotion and tenure process at many universities. Therefore, it is important to include administration in the planning stages and provide clear communication concerning the implementation and outcomes of projects of this nature.

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